crowd:it

Pedestrian Simulation Software

Contents

This brochure summarises the benefits and features of **crowd:it**, our pedestrian simulation software.

For more information, or for a demonstration of the software, please contact us:

E-Mail   crowd-it@accu-rate.de
Phone   +49 89 21 55 38 69

Introduction

When crowds form, understanding the interaction between people and space is vital. This interaction is complex; predicting crowd dynamics is a marked challenge for anyone engaged in crowd safety and comfort.

Make crowd dynamics more than intuition. With crowd:it, you can simulate evacuation concepts, analyse processes and evaluate the capacity of your facility or venue. And using crowd:it's many evaluation tools, you can communicate your findings with quick, self-explanatory results.

As a consulting practice, we understand what is important to simulation software: accuracy and usability. We continually refine our software with the latest scientific research so that crowd:it produces actionable results you can trust.

In the following pages we will explain how we use crowd:it productively on behalf of our clients. Join us in our quest to make the world a safer place.

Our story

In 2009, Dr. Angelika Kneidl started her PhD, researching microscopic simulations of crowds. In 2010, disaster struck the Love Parade Techno Festival in Duisburg: 21 people died and 650 were injured in a crowd crush. While the event is still under investigation, one thing is clear: better preparation could have prevented disaster.

We realised a simulator that is easy to use and always delivers dependable results would enormously benefit the safety planning of large events.

So that is what we built.

References

We proudly use **crowd:it** to consult for our clients:

Deutsche Bahn requested we stress-test their new train stations in the planning phase to uncover inefficiencies and improve safety and comfort.

For the largest folk festival in the world, **Oktoberfest,** we validated their safety concept and supported the public transport authority in maximizing the capacity of existing infrastructure.

The widely known museum **Castle Neuschwanstein** was built for one king and his entourage. Today, thousands of tourists visit the museum every day.
Our simulations supported the museum's management by testing and refining their evacuation concept.

On the following pages we will explain how **crowd:it** has been helping our customers save time and money, and how it enables you to do the same.

Picture shows custom 3D visualisation

Applications

Simulating pedestrian movement, though specialist, answers a broad range of questions:

› Prototype and optimise a building or event throughout its lifecycle.

› Stress-test worst case scenarios to prepare and reduce risk.

› Analyse pedestrian flow, ingress and egress times and optimise your plans.

› Validate safety concepts by observing how evacuations unfold.

Crowd simulation provides an important contribution to public safety. For event planning and fire safety, simulation is unique in revealing how space is used.

With **crowd:it** you can easily examine evacuation times, capacity limits and critical locations of your venue or event.

Crowd simulation has established itself as state of the art and will be defined by the International Organization for Standardization (ISO)/TC 92 (and in Germany in the DIN 18009:2).

The simulation workflow

Our experience has led to a concrete and proven simulation workflow that yields tangible results. **The process typically consists of four phases:**

Requirements Engineering

Modeling

Result presentation

Simulation and analysis
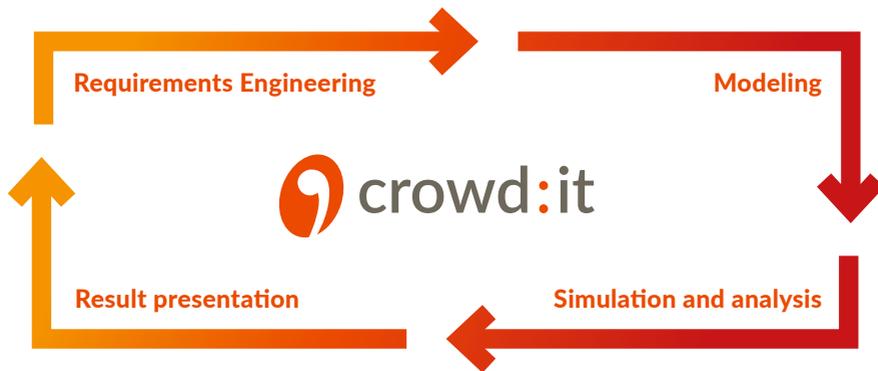
Requirements Engineering

Above all:
- What question do I want to answer with the help of a simulation?

Do I have:
- The demographics of the population?
- Relevant data, including: inflow & outflow?

Modelling

Create the geometry in your favourite CAD or BIM package:
- Define the simulation area.
- Clean and prepare the CAD drawing.
- Add simulation objects.

Specify simulation parameters in crowd:it:
- Convert the simulation objects into specific, agent-interactive objects.
- Define the population: number of agents, pre-movement times, speeds, etc.

Simulation and analysis

Simulation:
- Run randomly seeded simulations and any scenario of interest.
- Let **crowd:it** calculate the pedestrian flows for you.

Analysis:
- Analyse the results and compare them with given requirements.
- Review and consider refinements.

Presentation of the results

- Visualise the simulation(s) with our built-in video tool.
- Bolster your analysis by exporting beautiful graphs.
- Create a report of your findings across all scenarios.

Features

crowd:it offers many features that follow the user workflow, so that simulation and analysis are intuitive. Here is an overview of the most important functionalities for each phase of the workflow.

1 Modelling

In the modelling phase, the geometry and population must be prepared for simulation.

Compatibility with all CAD programs

With crowd:it's .dxf importer, you can import any CAD file in **crowd:it.** You can use whichever CAD software you prefer to prepare your floor plans.

> DXF · We have a list of CAD programs we have tested on our web site:
> https://www.accu-rate.de/en/compatible-cad-packages

If you are using a software package we have not yet tested, please write to us, and we will test it!

In **crowd:it,** you can convert specially-tagged objects into agent-interactive objects with a mouse click.

Agents with character

crowd:it allows you to configure your simulated agents. Use our default characteristics to get solid results quickly. Or, precisely define the population and profit from greater realism. Set:

- Agent size
- Agent walking speed
- Agent perception
- Group affiliation
- Individual plans & preferences

Background image

Background images provide context to a simulation and are easy to add with **crowd:it.** Save time by modelling only what you must, and add a background image to fill in the blanks.

2 Simulation and visualisation

The 2.5D output of crowd:it allows a scientifically correct view of your scenario. We pay special attention to solid charting and fast, repeatable evaluations. To catch your audience, use our 3D visualisation and create stunning videos.

Colour your agents

A simple way to make sense of a simulation and create clear analysis is to categorise agents and colour them according to their:

- Local density
- Speed
- Group size

- Origin
- Destination
- Evacuation time
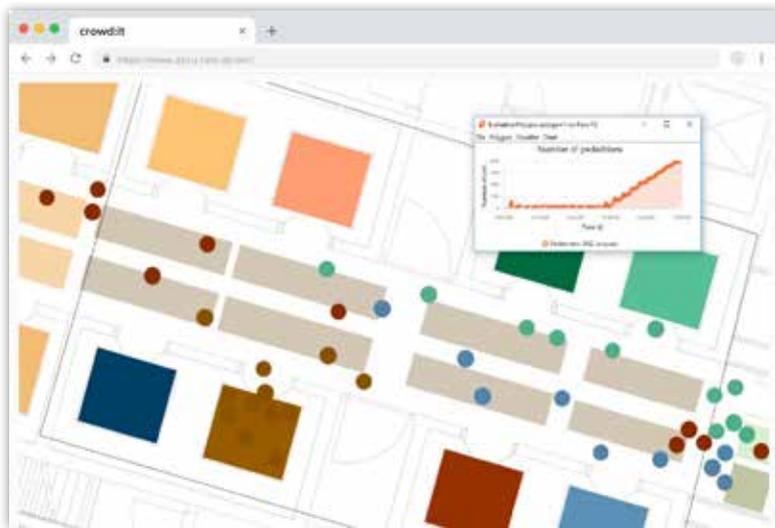
Visualise path usage

Identify at a glance which areas are most frequented. Visualise the precise paths of:

- All simulated agents
- Currently active agents
- Selected agents (by origin, destination, ID, ...)

3 | Analysis and report

Enrich your report with built-in tools that aid your analysis of the simulation and export videos and screenshots. The raw data of every chart can be saved as .csv files.

Heatmaps

Videos are easy to understand, but they don't print very well.
A viable solution is to fold time into colour. See bottlenecks and critical points of a lengthy simulation run at a glance using heatmaps. Overlay your floor plan with colours according to your criteria:

- Density
- Speed
- Geographical movement
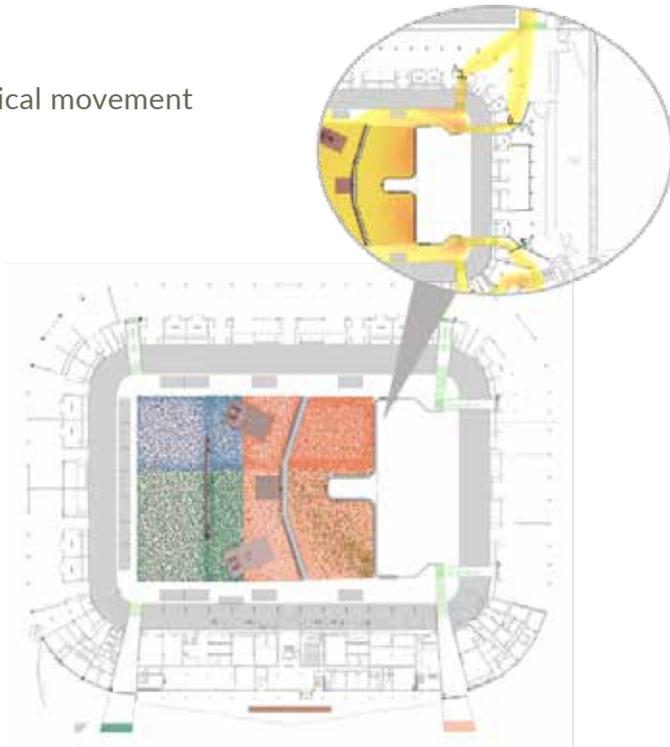
Detailed analysis: tripwires

Count agents crossing a line. Only here it's not proverbial, but a real line. Mark a line of interest, and see:

- Counts of agents crossing the tripwire
- Agent speed at the tripwire
- Journey duration between two or more tripwires

Detailed analysis: areas

Understand what happens in an area of interest. Mark areas of special interest directly onto the plan with rectangles or polygons and evaluate the agent behaviour within. Evaluations include:

- Agent length of stay
- Density
- Agent speed
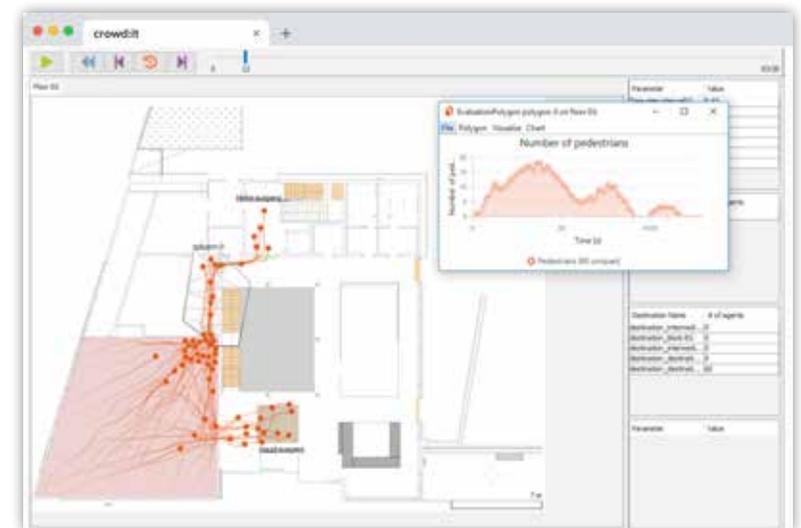
Scientific model

crowd:it is based on a three-tier model consisting of:

- A locomotion layer (how exactly do people move through space: The Optimal Steps Model).
- A navigation layer (graphs that map the orientation of people).
- A behavioural layer.

While the Optimal Steps Model provides a solid foundation for our simulation engine, pedestrian behaviour is what most of our current research efforts focus on. We consider the psychology of individuals and their social interactions.

- Every agent has an individual plan and personal characteristics.
- The underlying Optimal Steps Model enables real-world pedestrian stepping behaviour. Agents slow down naturally when faced with dense crowds by taking smaller steps. (Thus, no density-speed relation is needed as input.)
- By applying pre-selected heuristics, agents interact individually with space and events. This yields flexibility – model various situations simply, from scheduling to evacuation.
- Any number of agents, routes and characteristics can be combined.
- Our agents reflect real human behaviour, avoid collisions with each other and obstacles, and seek the easiest way to their destination. As a result, congestion, lane formation and inefficient pedestrian routing are depicted realistically.

Dynamic navigation field
- At each time-step, agents consider which route is best for them, given the current circumstance.
- They consider other agents as obstacles and, according to the situation, may decide on the longer but ultimately quicker route.

Continuous geometry
- Free direction of movement.
- A real pedestrian step is imitated.
- Avoid dangerous artefacts.
- All details of the plan are kept.

Validation and verification
We pass all applicable tests in the following suites:
- NIST technical note 1822
- IMO 1238
- RiMEA

For more information and scientific references, please see our website at **https://www.accu-rate.de/en/.**

Licensing

Packages

We offer four packages, which reflect various industry needs.
From event planners to fire protectors and facility managers –
we have the right solution for you!

Easy Event:
Prioritize security at your event – quick and simple.   3,000 €/year

Fire Safety:
Engineering methods for contemporary fire protection. 7,000 €/year

Smart Building:
Understand the processes of your building from initial
planning to operation.   12,000 €/year

Enterprise:
From large events to complex buildings – this package
includes all features and functions.   25,000 €/year

You can test **crowd:it** for one month!
Free Demo Version – 50 agents   00 €/month

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Pedestrian Simulation
Software

If you need any further information on crowd:it, please contact us:

E-Mail   crowd-it@accu-rate.de
Phone   +49 89 21 55 38 69

accu:rate GmbH

Institute for crowd simulation
Rosental 5, D–80331 München